

GetOnBoardBRT

BUS RAPID TRANSIT IN MONTGOMERY COUNTY

**US 29 BRT Project
CAC #12
Week of July 10, 2017**

CAC Reminders

- Approved Countywide Transit Corridors Functional Master Plan states CACs are formed to “make recommendations to the County on the ***design, construction and proposed station locations*** for the transit corridors.”
- CAC meeting topics have been selected to fit within this scope and are focused on the physical elements of the US 29 BRT project
- Questions on topics outside of this scope and the planned agenda for each meeting will be deferred to the end or after the meeting
- Success of meetings is dependent on mutual respect between members, County staff, and consultants
- CAC members can contact staff at any time following the meeting with feedback from their communities

Transit Signal Priority

US 29 BRT Project

CAC #12

Week of July 10, 2017

Agenda

- TSP Overview/Basic Concepts
- Benefits Of TSP
- TSP in Montgomery County
- Intersection Selection Criteria
- US 29 BRT Corridor
- Next Steps

What is Transit Signal Priority (TSP)

TSP is a traffic signal operational strategy that facilitates the movement of transit vehicles, either buses or streetcars, through traffic signal controlled intersections.

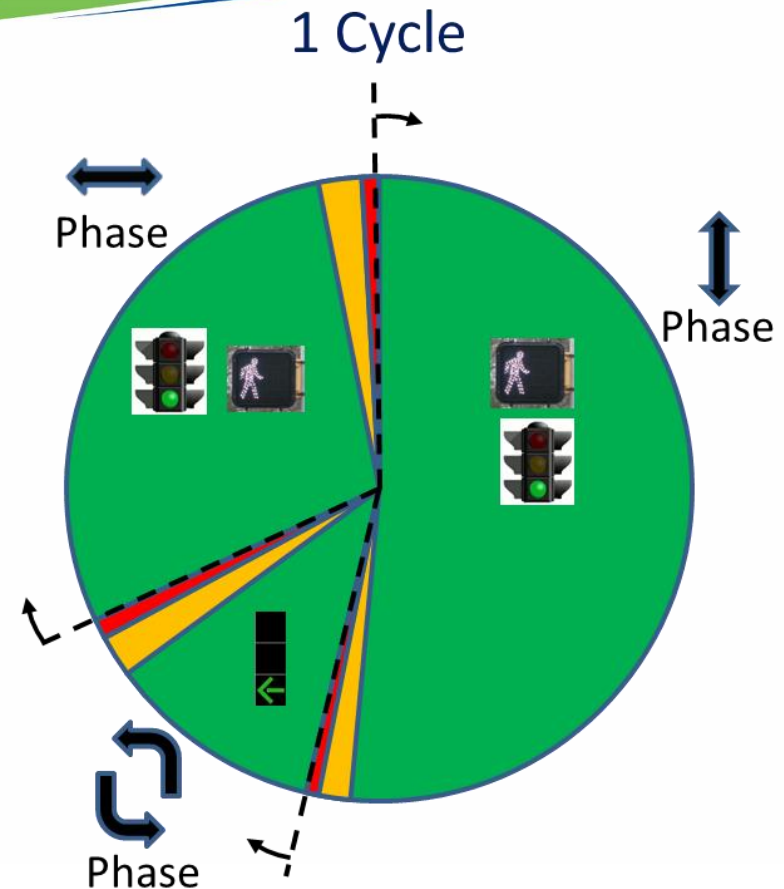
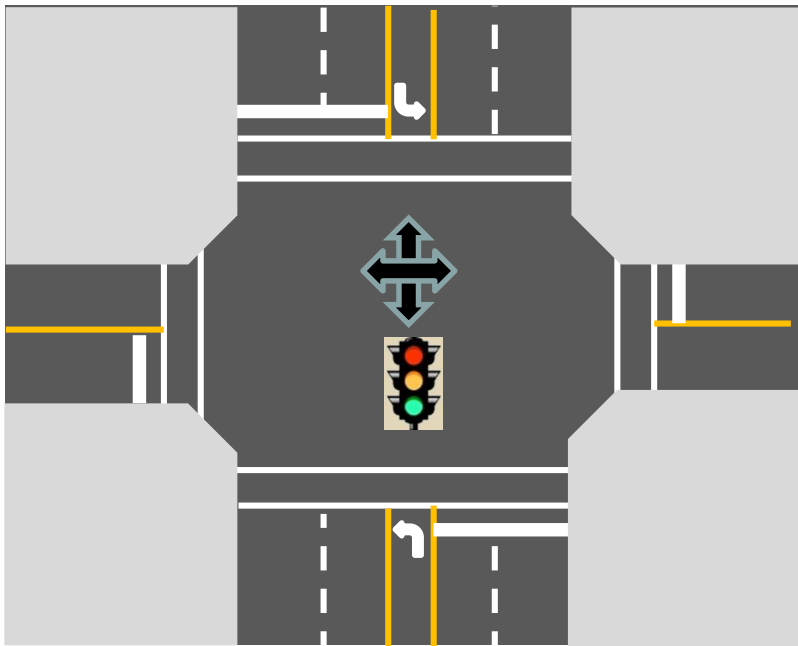
- Active TSP is used to provide passage for transit vehicles at signalized intersections when requested.
- Conditional TSP requests priority only if certain conditions are met.
- Signal Strategies.
 - Green Extension
 - Early Green (Red Truncation)



Active TSP is conditional priority, not to be confused with Emergency Vehicle Preemption which is unconditional priority

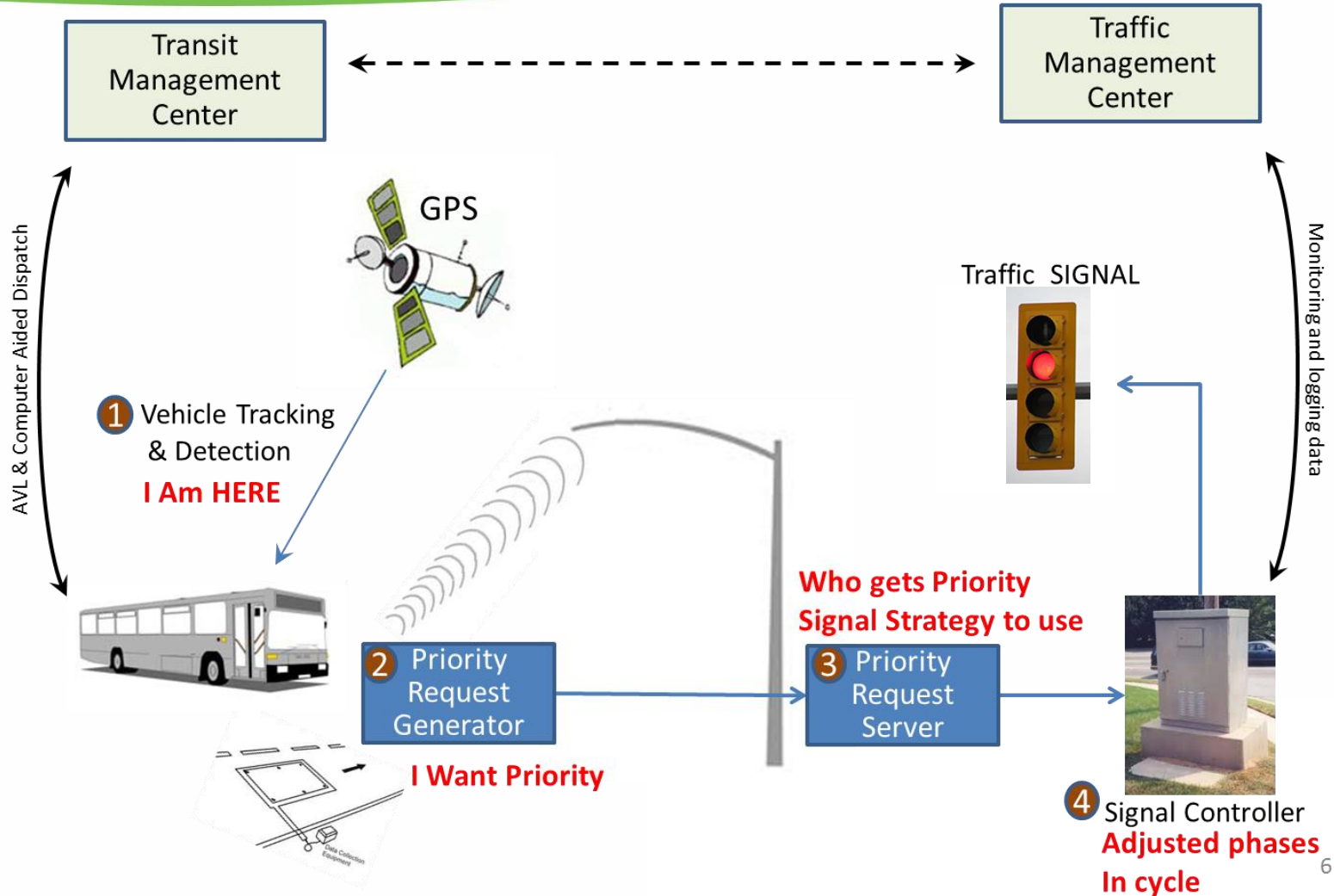
Traffic Signals: 101

- A Cycle consists of multiple Phases
- Phases allocate time to movements competing for shared right-of-way
- Phase Length is a function of geometry, and vehicle and pedestrian volumes (demand)



Cycle length is sensitive to many factors including coordination with adjacent signals; time of day; volume demand, and vehicle detection (e.g. loops)

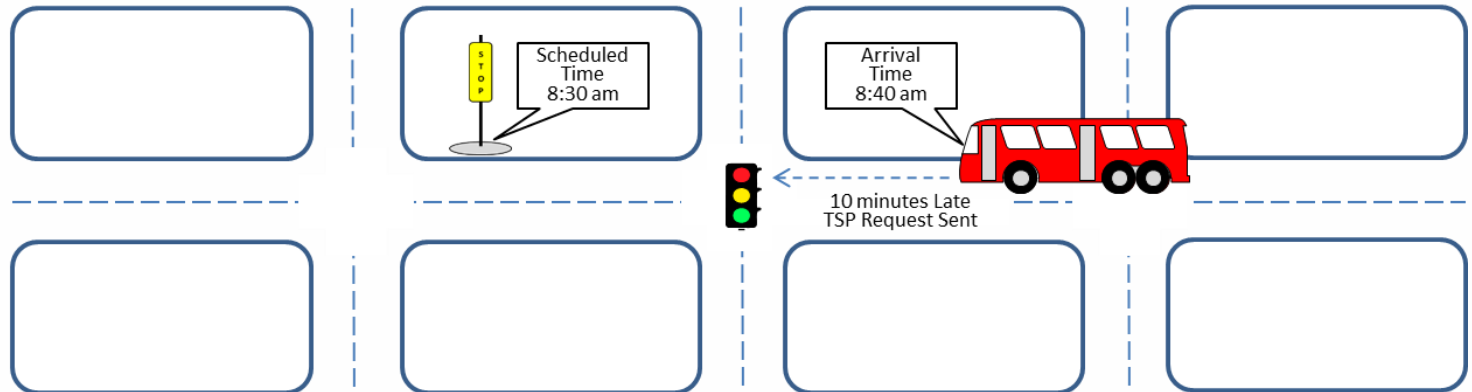
Conceptual Elements of Active TSP



Schedule VS Headway Management

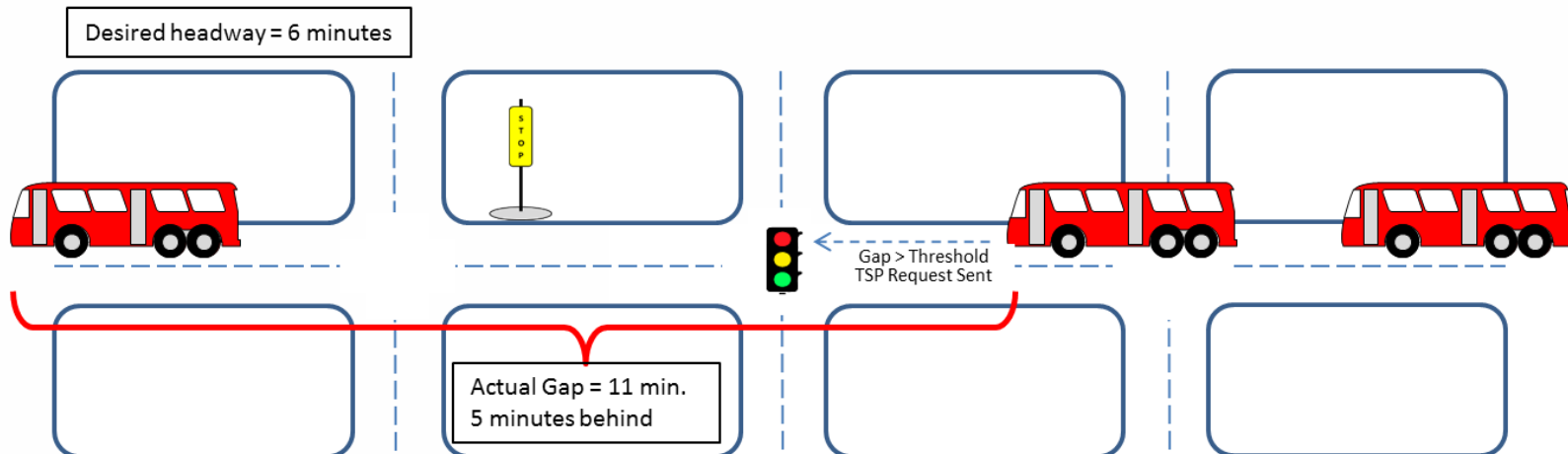
Schedule Management: Less Frequent Service (e.g. Headways > 10 minutes)

Conditional
Priority
Threshold:
5 minutes
behind
schedule



Headway Management: Frequent Service (e.g. Headways < 10 minutes)

Conditional
Priority
Threshold:
Gap $1.5 \times$
desired
headway =
9 min



How TSP Works within the Opticom GPS System TSP System



Benefits of TSP

Improve travel time reliability and schedule, reduce delay and reduce emissions, may increase ridership.

- Waiting at Traffic Signals represents an average of 15% of a bus's trip time.
- Travel Time Savings:
 - ✓ Range from 2 to 18 % in North America, with typical reductions from 8 to 12 %
 - ✓ Los Angeles MTA: 7.5 % time reduction due to TSP in 2 BRT corridors
 - ✓ Chicago: 15% travel time savings for buses in the Cermak Road TSP Corridor
 - ✓ New York City: 17 % travel time savings along a 2.3 mile Victory Blvd in Staten Island
- Bus Delay at Signals
 - ✓ Los Angeles, 35% delay reduction at intersections with TSP
 - ✓ Oakland: San Pablo Avenue Corridor buses saved 5 seconds per TSP intersection
- Conditional TSP
 - ✓ In an Orlando simulation study BRT and Conditional TSP “significantly improved travel times, average speed and average total delay per vehicle”.. “with only minor impacts on crossing street delays”.
 - ✓ In Salt Lake City Utah: Conditional TSP is estimated to reduce travel times 15%. The results showed that TSP has minor negative impact on side-street traffic and no impact or minor positive impact on main traffic.

Existing Signal Operations

~850 Signalized Intersections

- 65% (~ 550) owned by Maryland State Highway Administration (MDSHA)
- 35% (~ 300) owned by Montgomery County

Montgomery County DOT operates and maintains the MDSHA and County Signals and is responsible for TSP timing plans

Leveraged Capital Projects

- County Traffic Signal System Modernization (TSSM) project upgraded signal control to a modern distributed system
- Fibernet and TSSM provided a high speed communications network

TSP Past and Present

TSP was deployed to all Ride On buses in the 1990's

- Different technology, central system based
- Bus CAD/AVL and Traffic Signal System modernizations made this deployment obsolete

TSP Technology Pilot Test undertaken in 2013

- 3 traffic signals, 5 buses
- Successful test of modern TSP roadside and bus hardware

For current operations assuming no other transit priority treatments
(mixed flow operations)

- Extend Green Phase or
- Provide an early Green Phase

Ride On extRa featuring TSP will go in service Fall 2017

- 30 traffic signals and 17 buses from Gaithersburg to Bethesda

TSP for US 29 BRT Purpose & Goal

Purpose:

Help maintain consistent transit vehicle flows and travel times for BRT Service while reducing delays due to stops at traffic signals.

Goal:

Improve expected Transit Travel Times for travelers using the BRT system through improving reliability and reducing delays without undo negative impacts to the overall transportation system performance or other travelers.

Need:

Select 15 intersections for TSP equipment installation

TSP activation by time period will be determined during operations

TSP Objectives

BRT Transit:

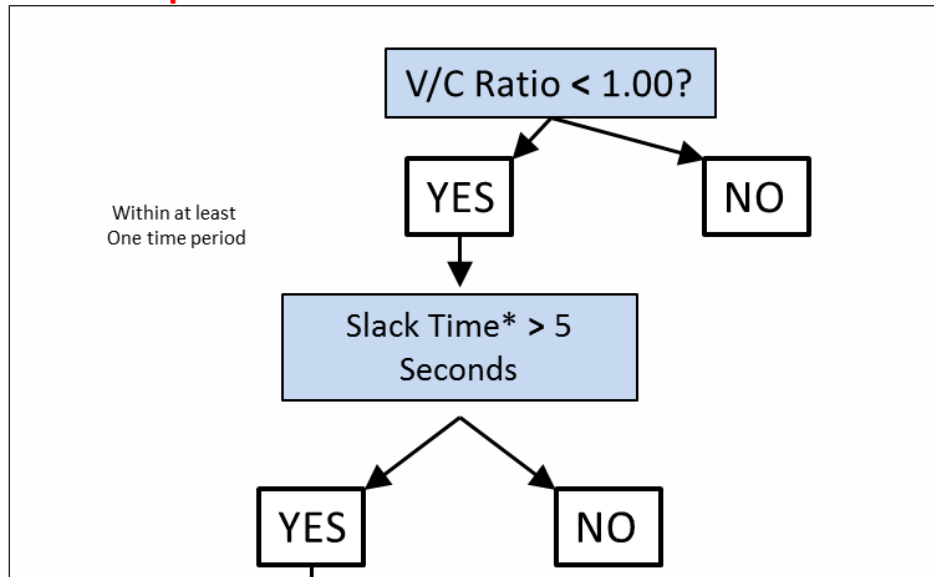
- Assist in providing consistent headways/ On time
- When conditions are met
 - ✓ Reduce Signal Delay
 - ✓ Reduce variation in time through intersection or segment
 - ✓ Limit severe (maximum) delay at intersections

General Traffic:

- Limit negative impact on general traffic (through and cross)

TSP Intersection Selection Flow Chart

TSP Acceptable at Intersection?



General Traffic

- Slack Time = Available Green: Cycle time minus all minimum pedestrian clearance and minimum left turn green times

TSP is Feasible.

Weighting Factors

- Cross street facility type
- Other priority treatments
- Bus stop/station location
- Bus Approach Speed
- Transit Ridership by direction
- Bus Frequency by direction

Transit Design and Service

Intersections for Implementation

TSP Weighting Factors

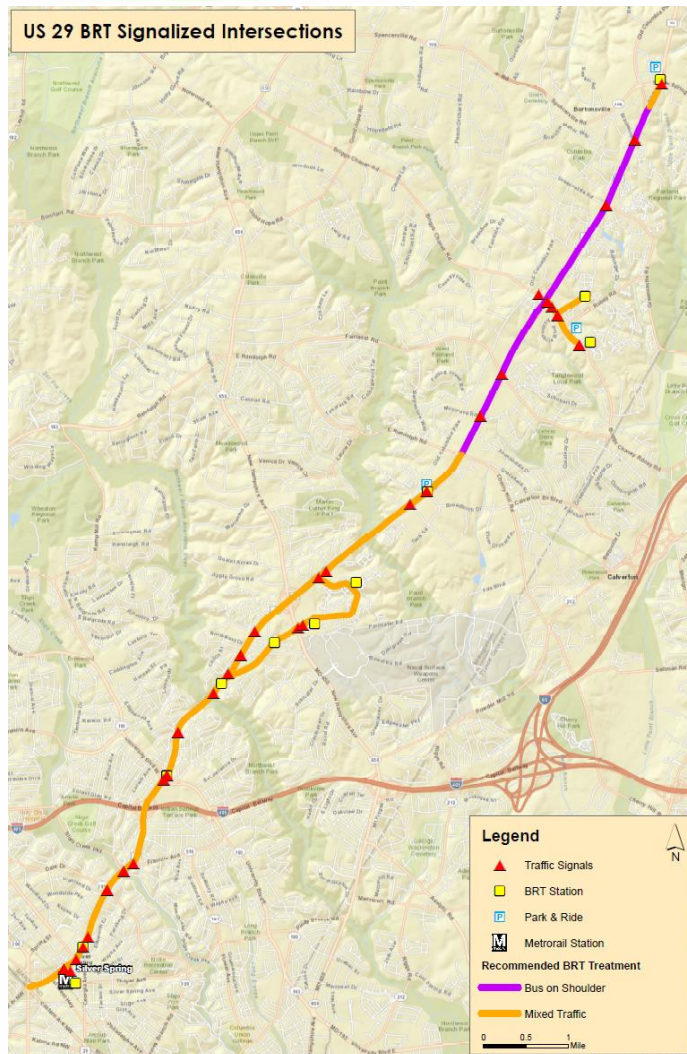
Applied to Acceptable TSP Intersections:

- Number of acceptable time periods (higher +)
- Cross Street Facility Type (Lower type +)
- Other Priority Treatments (Bus on shoulder +)
- Bus Stop Location (Far side +)
- Bus Approach Speed (slower than general traffic +)
- Other Transit Ridership (higher on parallel +)
- Other Transit Frequency (higher on parallel +)

+ means higher ranking

US 29 BRT Corridor Signalized Intersections

See Handout



| | |
|----|--|
| 1 | US 29 @ Blackburn Rd |
| 2 | US 29 @ Green Castle Rd |
| 3 | US 29 @ Fairland Rd |
| 4 | US 29 @ Musgrove Rd |
| 5 | US 29 @ Tech Rd |
| 6 | US 29 @ Industrial Pkwy |
| 7 | US 29 @ Stewart Ln Slip |
| 8 | US 29 @ Stewart Ln |
| 9 | US 29 @ Prelude Dr |
| 10 | US 29 @ Burnt Mills Ave |
| 11 | US 29 @ Lockwood Dr |
| 12 | US 29 @ Burnt Mills Shopping Center |
| 13 | US 29 @ Southwood Ave |
| 14 | US 29 @ University Blvd WB |
| 15 | US 29 @ University Blvd EB |
| 16 | US 29 @ Franklin Ave |
| 17 | US 29 @ Sligo Creek Pkwy |
| 18 | US 29 @ Dale Dr |
| 19 | US 29 @ Spring St |
| 20 | US 29 @ Fenton St |
| 21 | US 29 @ Georgia Ave |
| 22 | Colesville Rd @ 2nd Ave |
| 23 | 2nd Ave @ Ramsey Ave |
| 24 | MD 198 @ US 29 NB Ramps |
| 25 | Briggs Chaney Rd @ US 29 SB Ramps |
| 26 | Briggs Chaney Rd @ US 29 NB Ramps |
| 27 | Briggs Chaney Rd @ Outlet Dr |
| 28 | Briggs Chaney Rd @ Auto Dr/Castle Blvd |
| 29 | Briggs Chaney Rd @ Gateshead Manor Way |
| 30 | Lockwood Dr @ White Oak S.C. |
| 31 | MD 650 @ Lockwood Dr |

US 29 Corridor Available Green and V/C Ratio

See Handout

Opening Year 2020 Conditions

| # | Intersection | Movement NB/SB Bus | Total Available Green Time (sec) | | | | | | Volume to Capacity Ratio | | |
|-----------------|--|-----------------------|----------------------------------|----|----|----|----|----|--------------------------|----|----|
| | | | AM | | MD | | PM | | AM | MD | PM |
| | | | NB | SB | NB | SB | NB | SB | | | |
| 1 | US 29 @ Blackburn Rd | NBT/SBT | | | | | | | | | |
| 2 | US 29 @ Green Castle Rd | NBT/SBT | | | | | | | | | |
| 3 | US 29 @ Fairland Rd | NBT/SBT | | | | | | | | | |
| 4 | US 29 @ Musgrove Rd | NBT/SBT | | | | | | | | | |
| 5 | US 29 @ Tech Rd | NBT/SBT | | | | | | | | | |
| 6 | US 29 @ Industrial Pkwy | NBT/SBT | | | | | | | | | |
| 7-a | US 29 @ Stewart Ln Slip | NBT/SBT | | | | | | | | | |
| 7-b | US 29 @ Stewart Ln Slip | WBR/SBT | | | | | | | | | |
| 8-a | US 29 @ Stewart Ln | NBT/SBT | | | | | | | | | |
| 8-b | US 29 @ Stewart Ln | NA/SBL | NA | | NA | | NA | | | | |
| 9 | US 29 @ Prelude Dr | NBT/SBT | | | | | | | | | |
| 10 | US 29 @ Burnt Mills Ave | NBT/SBT | | | | | | | | | |
| 11-a | US 29 @ Lockwood Dr | NBT/SBT | | | | | | | | | |
| 11-b | US 29 @ Lockwood Dr | NA/WBL | NA | | NA | | NA | | | | |
| 12 | US 29 @ Burnt Mills Shopping Center | NBT/SBT | | | | | | | | | |
| 13 | US 29 @ Southwood Ave | NBT/SBT | | | | | | | | | |
| 14 | US 29 @ University Blvd WB | NBT/SBT | | | | | | | | | |
| 15 | US 29 @ University Blvd EB | NBT/SBT | | | | | | | | | |
| 16 | US 29 @ Franklin Ave | NBT/SBT | | | | | | | | | |
| 17 | US 29 @ Sligo Creek Pkwy | NBT/SBT | | | | | | | | | |
| 18 | US 29 @ Dale Dr | NBT/SBT | | | | | | | | | |
| 19 | US 29 @ Spring St | NBT/SBT | | | | | | | | | |
| 20 | US 29 @ Fenton St | NBT/SBT | | | | | | | | | |
| 21 | US 29 @ Georgia Ave | NBT/SBT | | | | | | | | | |
| 22 | Colesville Rd @ 2nd Ave | WBR/SBL | | | | | | | | | |
| 23 | 2nd Ave @ Ramsey Ave | NBL/EBR | | | | | | | | | |
| 24 | MD 198 @ US 29 NB Ramps | NBL/NA | | NA | | NA | | NA | | | |
| 25 | Briggs Chaney Rd @ US 29 SB Ramps | NA/WBR | NA | | NA | | NA | | | | |
| 26 | Briggs Chaney Rd @ US 29 NB Ramps | NBR/WBT | | | | | | | | | |
| 27 | Briggs Chaney Rd @ Outlet Dr | NA/WBT | NA | | NA | | NA | | | | |
| 28-1 | Briggs Chaney Rd @ Auto Dr/Castle Blvd | EBL/SBR | | | | | | | | | |
| 28-2 | Briggs Chaney Rd @ Auto Dr/Castle Blvd | SBL/WBR | | | | | | | | | |
| 29 | Briggs Chaney Rd @ Gateshead Manor Way | EBL/SBR | | | | | | | | | |
| 30 | Lockwood Dr @ White Oak S.C. | NBT/SBT | | | | | | | | | |
| 31 | MD 650 @ Lockwood Dr | NBT/SBT | | | | | | | | | |
| NB - Northbound | | | T - Through | | | | | | VCR < 1.00 | | |
| SB - Southbound | | | L - Left | | | | | | VCR => 1.00 | | |
| EB - Eastbound | | | R - Right | | | | | | | | |
| WB - Westbound | | | | | | | | | | | |

US 29 Corridor TSP Selection Weighting Factors

See Handout

Next Steps

- Incorporate feedback on selection criteria
- Finalize 2020 inputs
- Rank/Select intersections for implementation

Bikeshare Presentation

US 29 BRT Project

CAC #12

Week of July 10, 2017

Capital Bikeshare

- Regional Bike Transit service provided by the governments of DC, Arlington, Alexandria, Montgomery County, and Fairfax.
- 465 docking stations in DC, Arlington, Alexandria, Montgomery, and Fairfax
- Designed for point-to-point short trips of under 30 minutes
- Trips under 30 minutes are free with membership. User fees accumulate for each additional $\frac{1}{2}$ hour over 30 minutes.
- Types of Membership:
 - Annual = \$ 85.00
 - 30-day = \$ 28.00
 - 3-Day = \$ 28.00
 - 24-hr = \$ 17.00
 - Single Trip Fee = \$2.00



Capital Bikeshare in Montgomery Co.

Capital Bikeshare in Montgomery County Launched in September 2013 with 14 Stations!

70 stations are now up and running in 5 geographic areas feeding Metrorail:

- Silver Spring / Takoma Park
- Bethesda / Friendship Heights
- Rockville / Shady Grove / Life Sciences Center
- Chevy Chase Lake
- Wheaton

Why Use Bikeshare?

- A majority of Members chose bikeshare because it was a faster or easier way to reach their destination (56%)
- 71% of Members use bikeshare to access transit
- 65% of Members use bikeshare to commute to work
- One-third of Members increased their use of Capital Bikeshare in response to Safe Track
- Members substantially reduced their car, ride-hailing and taxi use with more than half who drove their car less often
- Members save on travel costs
- 80% of Members are more likely to patronize businesses that are accessible by Capital Bikeshare

STATION @ Carroll & Ethan Allen in Takoma Park



The Stations

- Solar-powered, not wired to the grid
- Modular design, not bolted down
- Consist of docks, bikes, solar panel, kiosk, map panel
- Station sizes: Usually 11, 15, or 19 docks
- Ideal bike to dock ratio is 50%

Criteria for Locations

Safety for cyclists, pedestrians, and motorists

4+ hours of direct sunlight each day

Visible and easily accessible

Low impact on pedestrian and motorist sight distance

Adequate clearance on sidewalk or street

Close to transit, major employment sites, dense residential and retail

Access for Rebalancing Van and for Boom Truck for installation

Minor arterials and lesser streets with slow speeds

1 to 1.5 miles to nearest bikeshare station or direct access to major transit

Funding for Bikeshare Stations

All Montgomery County bikeshare stations are funded by grants or developer contributions:

86% by grants

14% by developer contributions.



10 Bikeshare Stations serving the US 29 BRT will be funded by the TIGR Grant

Bikeshare Expansion in Montgomery

Stations Installed in 2016 /2017

2016 Installs:

Connecticut Avenue & Chevy Chase Lake Drive in Chevy Chase Lake (Developer funded)

Key West Avenue and Siesta Key Way in Rockville (Developer funded)

Medical Center Metro Station in Bethesda (State Grant funded)

Lyttonsville Road & Lyttonsville Place in Silver Spring (State Bond Bill funded)

Woodmont Avenue & Strathmore Street in Bethesda (State Bond Bill funded)

East - West Highway & 16th Street in Silver Spring (State Bond Bill funded)

Sligo Avenue & Carroll Lane in Silver Spring (State Bond Bill funded)



2017 Installs:

Pooks Hill Avenue & Linden Lane in Bethesda (State Bond Bill funded)

Kirklynn Avenue & MD 650 in Takoma Park (State Grant funded)

New Hampshire Avenue & Merwood Drive in Takoma Park (State Grant funded)

Amherst Avenue & Elkins Street in Wheaton (State Grant funded)

Grandview & Blueridge Avenues in Wheaton (State Grant funded)

Wheaton Metro Station (State Grant Funded)

Amherst Avenue and Pritchard Road in Wheaton (State Grant funded)

Windham Lane & Amherst Avenue in Wheaton (State Grant funded)

Shady Grove Metro Station East Entrance (Developer funded)

Columbus Avenue & Grammercy Boulevard near Shady Grove Metro (Developer funded)

Columbus Avenue & Tribeca Street near Shady Grove Metro (Developer funded)

Key West Avenue & Great Seneca Highway in Rockville (Developer funded)

Stations Coming Soon

Fall 2017:

Diamondback & Decoverly Drives at Camden Shady Grove (Developer Funded)
Blueridge Avenue and Elkin Street at AVA Wheaton (Developer Funded)

Spring 2018

(Funded by Maryland Bikeways Grant for White Flint & Twinbrook)

Citadel Ave & McGrath Blvd

Congressional Ln & E Jefferson St

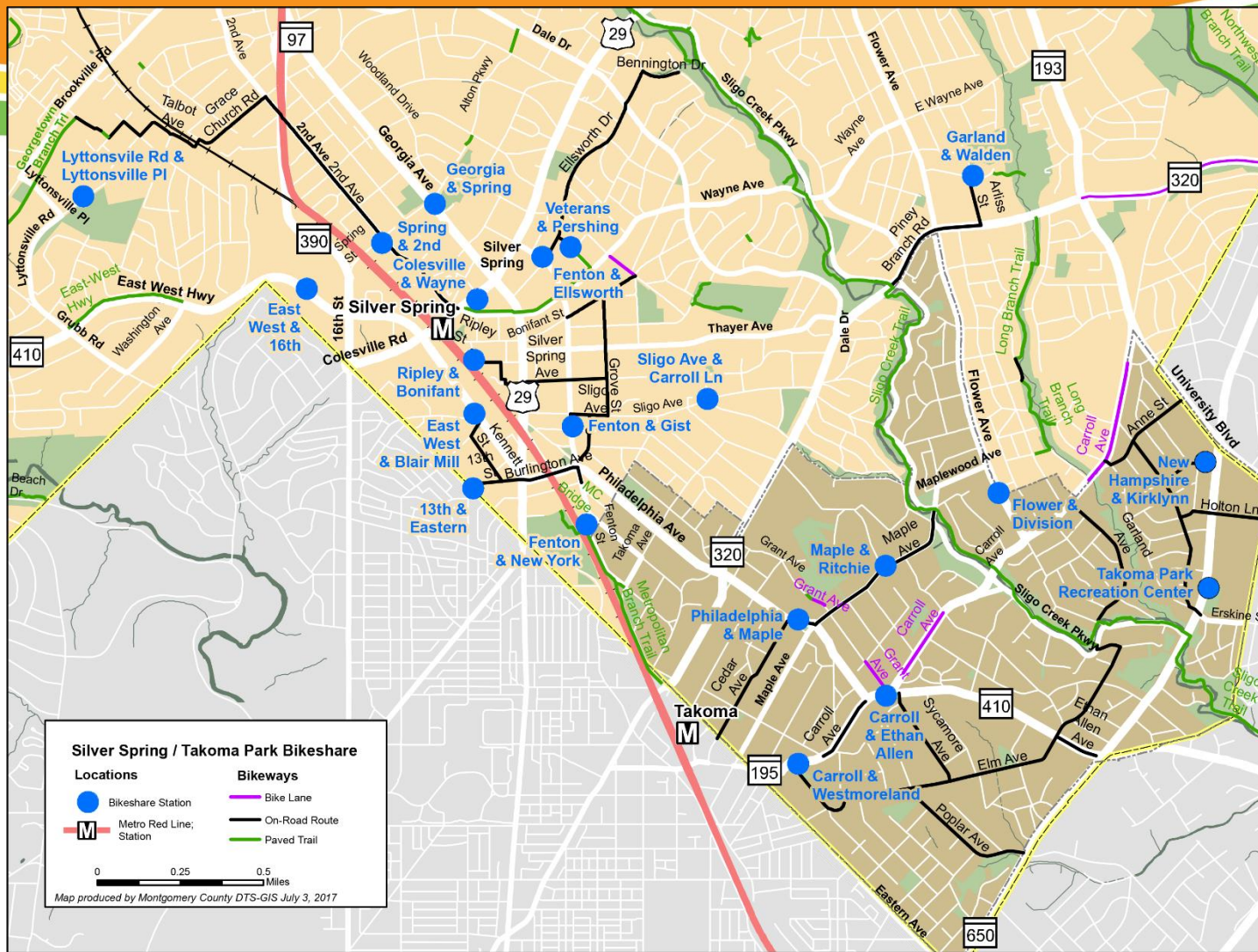
Fishers Ln & Rock Creek Mill Rd @ JBG (includes developer contribution)

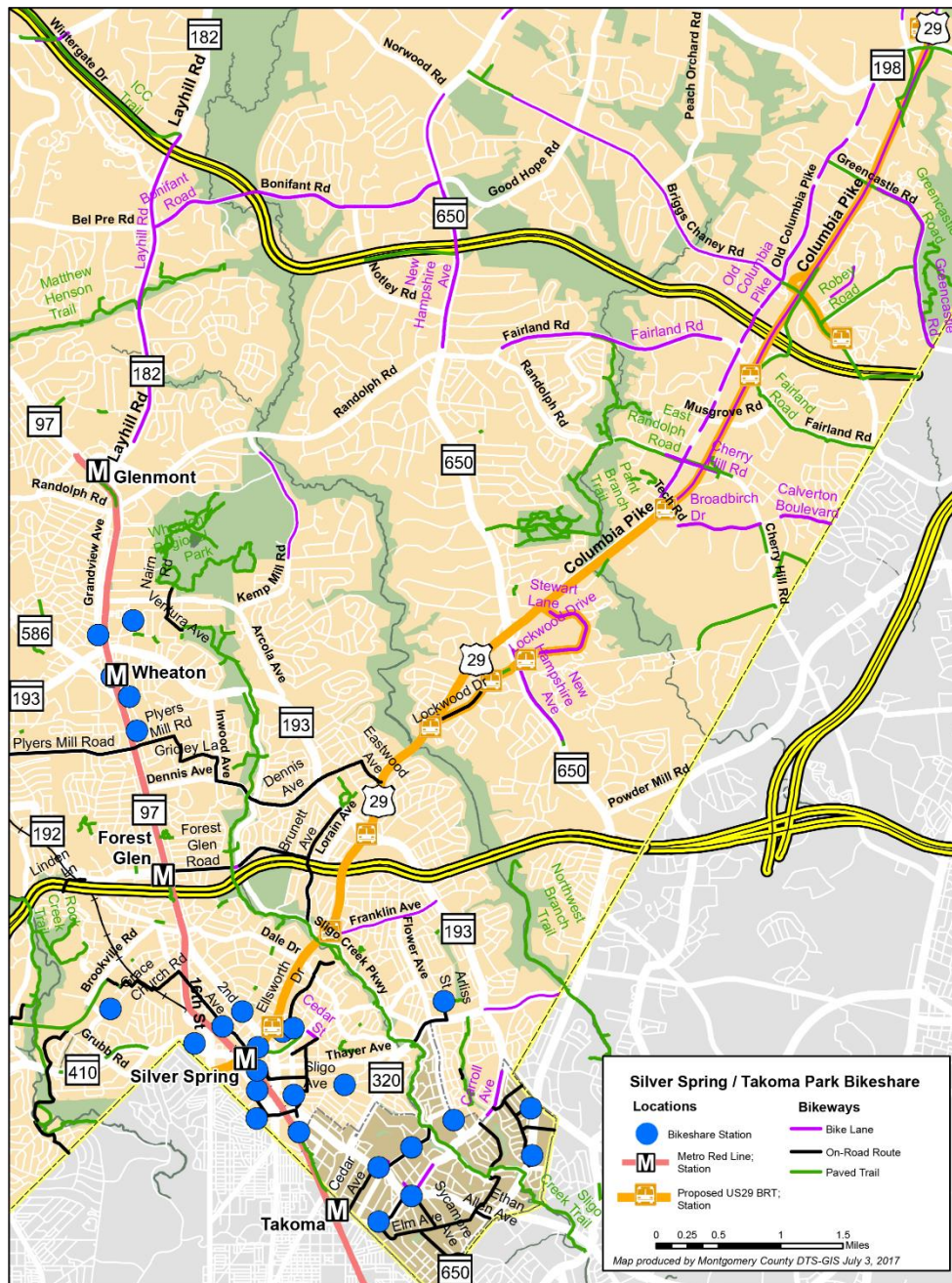
Old Georgetown Rd & Rockville Pike

Twinbrook Metro

White Flint Metro

Woodglenn Dr & Executive Blvd





BIKESHARE TRIPS INCREASING!



Over 16.8 million Capital Bikeshare Trips system-wide in the first 6+ years of operation. Capital Bikeshare includes stations in DC, Arlington, Alexandria, Montgomery and Fairfax.

15% of the region's Capital Bikeshare stations are located in Montgomery County, feeding the Metrorail Red Line

Trips in Montgomery comprise about 2% of all the trips across the Capital Bikeshare System.

General Ridership

Highest ridership months for bikeshare generally are April – September.

Bikeshare ridership patterns in Montgomery County correspond to morning and evening peak hour travel on weekdays

There is a slight uptick in bikeshare trips at mid-day

Bikeshare Stations at or near Metrorail Stations tend to be the most popular.

Safety Elements of the Bikeshare Program

Promotion of Bicycle Education and Safety Classes

Distribution of printed materials with safety tips and messaging

Promotion of program with reflectors for safe riding at night

Free helmets to lower income users, and helmets used as raffle items at marketing/outreach events

Subsidized sale of helmets at \$16.00 when members join

Stickers with safety messages placed on each bike

Text promoting helmet use and safe bicycling on Capital Bikeshare station equipment

Signage in bikeshare service areas



Friendship Heights Metro